PyroTechnics

number 35

DECEMBER, 1984

Greetings from sunny (well, most of the time) California! As many of you have already heard, Lee Hart has passed the *Pyro* ~~albatross~~ baton to yours truly, Jamie Hanrahan. With lots of help from Gail, my meta-editor (I edit everyone else's stuff; she edits mine) and from Greg Ruffa (recently relocated to these parts), I hope to reestablish a somewhat-regular schedule for *Pyro*. As with all transitions, there will be a few glitches before things are running smoothly under the new regime; please bear with us.

This *Pyro* is going to everyone on the GT list, regardless of whether you have a current sub. We could have sent a form letter to all those who don't, but the postage for that would've cost as much as mailing the zine. Besides, it seems obvious that putting a *Pyro* in your hands and saying "send us something if you want more" will get a much better response than sending you a form letter saying "send us something if you want a *Pyro*" would have.

We're also sending this, the first of the "new" *Pyros*, to a whole lotta other folks who've probably never heard of *Pyro* or GT, but whom we hope will be interested in the zine. This is part of our new editorial policy. If you are one of this group, welcome! What we have here is not quite a clubzine, certainly not a genzine, and not exactly something in between. It is in a state of transition, and we're not entirely sure just *what* it will turn out to be. (This may be viewed as either "lack of direction" or "flexibility" on the part of the editorial staff, as you prefer...) We hope you are interested enough to stick around for a while and help us move in whatever seems to be the right direction.

"*What* new editorial policy?" I hear you cry. Well, first and most important, the trend that's been evident in several of the last few issues will be continued, but with conscious intent. What does that mean? Well, if you imagine a cover reading "*Pyrotechnics* -- the nuts-and-bolts fanzine", or "*Pyrotechnics* -- the hard sf fanzine", or "*Pyrotechnics* -- the fanzine with rivets", you'll get the idea. (Speaking of covers, I could use some...) That doesn't mean that we'll run nothing but material that praises hard sf to the skies; it does mean that if you're at all interested in hard sf, you'll probably find some things of interest in *Pyro*.

We'll continue our role as the newsletter of General Technics, but unless GT activity increases radically, that role will, necessarily, be somewhat small.

Second, distribution of *Pyro* will no longer be limited to GT members. Or, to put it another way, the *Pyro* mailing list and the GT mob list will no longer be synonymous; the latter will be a subset of the former. Beginning with this issue, *Pyro* is available to all comers, not only by subscription but also for "the usual" (i.e. contributions of artwork, articles, and LOCs, and/or by trade with other faneds). Since the new-and-improved *Pyro* will (hopefully) be of interest to more people, it only makes sense to make it more widely available.

Third: A LOCs column will be a regular part of every issue (assuming, of course, that we get some). No point in offering people free zines in exchange for LOCs if you don't print them! I will run letters pretty much as-is and with a minimum of return fire.

(Long-time readers, please note: I don't see this "new policy" involving an actual change in content so much as a perceived shift in direction and intent. Many of the best *Pyros* recently have contained little that was solely of interest to GT folk, and much that might be of interest to others. All I'm really trying to do is to make contact with the latter (much larger) group.)

I know that there are many things I've left unsaid. If getting *Pyro* doesn't automatically make you a GT member, just what does? (I should quickly add that the status of all *current* members is unaffected!) What can be done to get GT out of the doldrums? What about the General Technics Information Handbook? And so on... We'll tackle these issues later, after we've (hopefully) gotten some feedback from you.

In the meantime, this column has used enough space and time already, and I want to get this zine out the door. We have the second installment of Greg's column on urban-bound stargazing, the first of what I hope will be a series of articles on 1980s-style hard sf, and several other features. I'm aware that our first ish is heavily sercon; whether that remains a permanent feature of *Pyro* depends almost entirely on what kinds of contributions we get.

Please write and let us know what you think. We'll print a representative sample of the mail, as much as will fit (unless you mark your letter with DNQ), and we'll implement whatever suggestions we can. ■

PYROTECHNICS is a general-interest fanzine focusing on hard sf and on real-world science and technology. It also serves as the journal of the ~~organization~~ ~~club~~ mob of tech-minded fen known as General Technics. It is available in exchange for publishable articles, artwork, cartoons, and/or LOCs; by (preferably prearranged) trade; or by subscription at the rate of $3 for four issues (theoretically one year's worth). To receive PYROTECHNICS, send one (or more) of the above to

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(Make checks payable to one of us personally, not the zine.) Text-only contributions and other correspondence can be e-mailed via Usenet to

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but if you don't know what that means, don't worry about it.

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Hard SF in the 80's

Part One: Where Have All The Engineers Gone?

In the beginning there was Jules Verne. Call him the grandfather of science fiction. (Then H. G. Wells was the father, Hugo Gernsback was the midwife, and John W. Campbell, Jr. was the grammar school headmaster. But I digress.)

Consider, for a moment, Twenty Thousand Leagues Under the Sea. What aspect of 20K Leagues is common to many of the great 'hard' science fiction tales that have been written since?

Answer: Captain Nemo's dual role. Not only does he command the Nautilus, and therefore occupy center stage; he also built the Nautilus. He is both the inventor and the user of his invention. Obviously he is the complete master of his fate. Or so it seems at first.

The same is true for many of Wells' stories. Think of the Time Traveler and his machine, or of Dr. Cavor and Cavorite. The protagonists invent a marvelous gadget, then use that gadget to propel themselves into an adventure.

The same thread runs through stories as diverse as "Doc" Smith's Skylark books and George O. Smith's "Venus Equilateral" stories. Richard Seaton invents a star drive, gets his fiancee's rich father to help him build a ship around it, and takes off. Later on he runs into some technologically superior races who loan him some more advanced hardware, but he keeps improving on it, often saving the day thereby. Don Channing may be the chief administrator of a space station, but he's never so buried in paperwork that it keeps him from drawing schematics on tablecloths and splashing solder around the lab, every chance he gets. Again, one of the things about these people that commands our attention is their apparent mastery of their own destiny -- which is due almost entirely to their skill as engineers and technicians.

> "Looks like rivets are back!"
>
> --- overheard at the close of the LACon II Hugo Award ceremonies

By the 1950s the concept was wearing a little thin. Heinlein still managed to do a good job with it in Have Space Suit, Will Travel. He couldn't believably have 18-year-old Kip Russell build a whole starship by himself, but he could have Kip win an old spacesuit in a silly contest, and spend his summer restoring it the way ordinary kids would restore an old car -- and then, when he happens to be out testing the suit, he gets swept into an adventure in which the suit saves his life. Several times.

The appeal to the tinkerer in us is strong. We can identify with these characters because they're a lot like us, at least at first. The only apparent reason that they're having all of those wonderful adventures and we're not is that we haven't tinkered with the right stuff (ugh) yet.

This is the root of the appeal of a whole sub-class of hard sf, one which I've chosen to call "engineering fiction". Engineering fiction is the Tom Swift story, grown up and become (somewhat) respectable. For many of us, e.f. was all the sf there was at first. It got many of us in trouble as we tried to duplicate our heroes' experiments and ended up blowing up the basement or short-circuiting the neighborhood's phone system. On a happier note, it got many of us into careers in engineering, or failing that, in programming. Well-written examples of the genre (e.g. Venus Equilateral) still have great appeal, and so we frequently wonder why No One Writes That Stuff Any More.

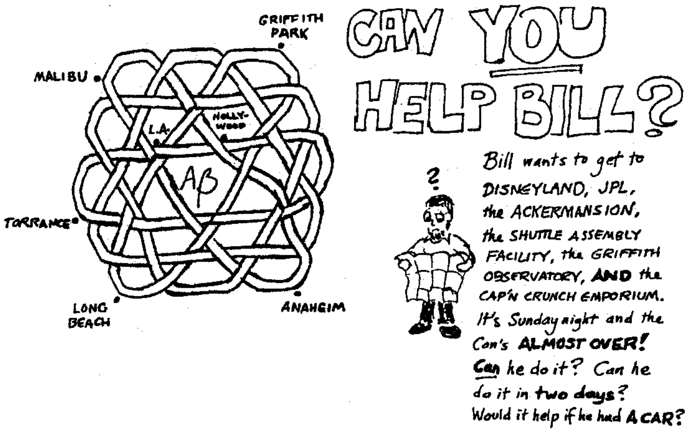
Alas, we've all grown a little too old, and a little too wise.

The change that made engineering fiction an obsolete art form was gradual; it probably started sometime in the 1920s or 30s. The country was hearing less and less about the great inventors like Bell and Edison and the Wright Brothers and more and more about what companies were doing. During World War II, while there were many heroes, none of them were engineers; they were the people who used what the engineers built. The planes and tanks and guns were built by companies with names like Lockheed, Chrysler, and Colt, not by people. Or so it seemed.

The real turning point came, I believe, with the American space effort. We were presented with an accomplished feat -- Russia's Sputnik I -- and rushed to match it, and surpass it. And when the astronauts circled the earth and the camera panned over Mission Control at the Cape, we learned that the day of great inventions by individuals was gone forever.

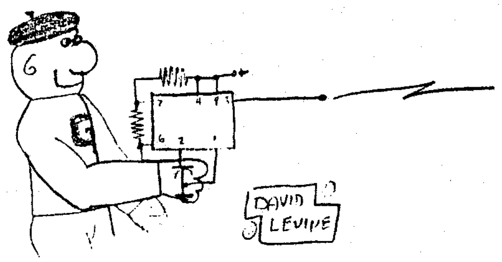
Why, the astronaut needed scores of people on the ground just to help him fly the thing! The equipment came from not one, but dozens of major contracting companies and thousands of subcontractors! Oh, we joined the cheering mobs and yelled ourselves hoarse welcoming our heroes home, but we didn't miss the point. True, the man in the motorcade had done something no one else in the program had: Put his life on the line, trusting all the systems to work, all at once. But he had plenty of help.

Many of us (those who hadn't already) resolved then and there that if we couldn't go into space ourselves, we'd damn well be part of the team helping to send someone else. But we also had the point driven home to us that without the team, one individual couldn't accomplish much at all.



CAN YOU HELP BILL?

Bill wants to get to DISNEYLAND, JPL, the ACKERMANSION, the SHUTTLE ASSEMBLY FACILITY, the GRIFFITH OBSERVATORY, **AND** the CAP'N CRUNCH EMPORIUM. It's Sunday night and the Con's **ALMOST OVER!** Can he do it? Can he do it in **two days**? Would it help if he had **A CAR**?



Another dream that died a hard and fast death around then was that of the spaceship-as-independent-vehicle. The ships our fictional heroes flew could take them where they wanted to go, bring them back, accommodate a stowaway on the return flight, and work in a side trip to Mars, all without even a glance at the fuel gauge. While most of the public puzzled over the space program's fussiness over "launch windows", we remembered a story called "The Cold Equations", and reviewed what we'd read about mass ratios; a spaceship can no more afford to take along "extra" fuel than a runner can afford an "extra" twenty pounds of body weight.

So even if we could build a spaceship in our back yard, it wouldn't give us the freedom to have adventures that we once thought it would. Thoughts of miracle fuels that would solve all those nasty problems dimmed as billions of dollars were poured into Project Apollo and no miracle fuels materialized. Thoughts of spending our lives touring the universe in our homebrewed ships faded under the harsh flourescent glare of the office lighting. We resigned ourselves to leaving our fates in the hands, not of a chief engineer, but of a CEO who probably wouldn't know a T-square from a slide rule.

The women's movement has made us aware of another problem with those old tales: In general, the authors gave their female leads pretty short shrift. Female engineers, if they appeared at all, were either plain, or beautiful-but-cold. And when it came time to get into the newly-built ship and fly off into trouble, they never were in the pilot's seat. This didn't bother the typical youthful male reader of the 50s or 60s, but unless we are so callous as to dismiss the women's movement out-of-hand, it's painfully obvious now. (And we wonder why so few women are motivated to get into engineering and hard science fields.)

The upshot of all this is that engineering fiction, which was always escapist fantasy wrapped in the trappings of hard science, has become just too fantastic to escape into. That's why No One Writes That Stuff Any More; no one would believe it long enough to enjoy it. When we read an older story, we seem to be able to adjust our expectations to allow for the time at which it was written. But new stories in the genre just won't stand up.

In many ways that's a pity. We need stories that encourage people to get into science and engineering. But those stories will have to portray realistic scientists and engineers accomplishing realistic feats. There will be no more Don Channings or Richard Seatons; no, never again. ■

General What??

Greg Ruffa

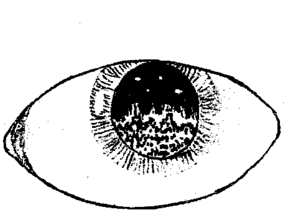
As has come to be expressed more frequently of late by various members of General Technics, this group is losing any real sense of cohesion and is slackening in activity of any sort either at conventions or in print. Causes for this have been argued: It is generally suggested that because GT is, on the whole, aging, there are fewer students and hobbyists among us and more members who are now involved in their lives and their professions. There is much concern over why we still don't do some of the neat things we used to do five years ago.

I'm not going to attempt to propose any remedies of the sort to try to recapture the past. Certainly we could stand to encourage more people to join GT, but I think we are in a position to do something more. We have roughly one hundred people who have not merely a wide variety of technical abilities, but a yet broader array of interesting knowledge and skills. I think it would be of considerable benefit not only to GT but to the general public for us to offer that knowledge or teach those skills to others.

Not many of us may be in a situation or a geographical location where we could do that by teaching, say, at a community college (although that isn't as hard to arrange as some may imagine). But I would guess that most of us go to science-fiction conventions, where there is known to be a ready audience for all sorts of worthwhile ideas. GT has given occasional sessions on building certain sorts of items. That is fine up to a point, but I feel we could do more than only demonstrate what amounts to toy-making. We know about a lot of things other people want to, or need to, know about. It is not all that hard to get onto a convention program and you won't often find an audience as receptive and eager to learn.

I believe that efforts of this sort can be of benefit to us in a few ways. We would gain a larger focus for our know-how and energies. We would be combatting the outsider's preconception of GT as a rather self-absorbed group of tinkerers (which I surely don't believe we are). Further, with a modest bit of self-promotion, we may well succeed in getting more folks to join with us. Next time, this 'zine will carry a couple of pieces on some of the program activities conducted by some of our members, which may give you some ideas for carrying something out at a con yourself! ■

THE Urban Eyeball



Part II: the Winter Sky

by Greg Ruffa

The winter sky is widely regarded by stargazers of all sorts in the Northern Hemisphere to be the most beautiful of the entire year. One reason for this feeling is due to the special steadiness and clarity of the air in that season. Because the ground is at its coolest at that time, atmospheric convection is weakest, thereby setting up less turbulence than at other times of the year. The stars appears most like sharp, bright points of light during the depths of winter. The other reason is that the band of the Galaxy nearly bisects the sky from northwest to southeast, presenting a great many of the brightest stars to view.

As one faces to the south, one is struck by the domination of that part of the sky by some of these gleaming pinpoints. Many people make a large array, called the "Winter Triangle," of brilliant, blue-white Sirius, white Procyon, and reddish Betelgeuse. It is becoming common now to see this as part of a yet larger grouping, the "Winter Hexagon," comprised of Sirius, Procyon, Castor and Pollux, Capella, Aldebaran, and Rigel. This vast stellar polygon, enveloping as it does the luminous constellation Orion, is the spectacle of the winter sky.

Orion is one of the one-and-a-half constellations best known to practically any American (the half is the bright portion of Ursa Major called the "Big Dipper"). It was familiar to all Western cultures; the name may have derived from *Uru-anna*, "the Light of Heaven," an Akkadian term originally applied to the Sun. In early Arabia, it was called *Al Jauzah*, "the Central" figure of the heavens and was seen as a black sheep bearing a white spot on its body. Orion comes down to us from Greek mythology as a human figure, with a shield raised in his left hand and an uplifted club in his right, facing the charge of Taurus, the Bull.

Betelgeuse, the name stemming from *Ibṭ al Jauzah*, "the Armpit of the Central One," is a red supergiant star about 520 light-years away. It is an irregularly pulsating variable star and, in fact, the only marked variable among the first-magnitude stars. Since the British astronomer John Herschel (son of William Herschel) discovered the variation in its brightness in 1836, the apparent brightness of Betelguese has wandered between 0.2 and 1.2, a factor of about 2.5. Its size is believed to vary from 550 to 920 times that of the Sun, which would cause it to extend into the asteroid belt in our own solar system. The intrinsic luminosity of the star varies between 7600 and 14,000 times that of the Sun; the surface temperature is 3100 K (5100° F.). Only about 13% of all the radiation from Betelgeuse is visible; the rest is in the infrared. If we could see the totality of the output, this would be the brightest star in our skies. As it has about twenty times the mass of the Sun and is now a pulsating red supergiant, current theories of stellar evolution indicate that Betelgeuse could become a supernova any time in the next million years. If it were to explode at the present time, it would become about as bright as the full Moon; it would be visible even in daylight for perhaps a year!

At the diagonally opposite corner of Orion lies *Rigel*, which derives from *Rijl Jauzah al Yusrā‘*, "the Left Leg of the Jauzah." It is a blue supergiant, like Deneb, having a luminosity 57,000 times greater than the Sun's, making it one of the most powerful stars we know of in the Galaxy. It is about fifty times the mass of the Sun and 50 times the size; its surface temperature is 12,600 K (22,200° F.). It is thought to be about 900 light-years distant, still making it the seventh brightest star in the night skies.

Rigel is the brightest member of a large grouping of giant blue-white stars called the Orion association, a region of currently-active stellar formation. (This area is shown spectacularly in one of the best known of the IRAS photographs.) These massive stars evolve very rapidly and destroy themselves in supernova explosions, splattering all manner of chemical elements (including the so-called "artificial" ones) into the surrounding space. These new nuclei are added to the material already present in the giant molecular cloud out of which these stars originally formed; the shock wave produced by the enormous blast compresses the gas and dust ahead of it, leading to the gravitational collapse of more of the cloud's substance into new stars and planets and, perhaps, living things. Rigel will itself attain this destiny in less than ten million years.

One of our Galaxy's dwarf-galactic companions lies about 70,000 light-years from us in the general direction of Betelgeuse. It is a small irregular galaxy being torn apart by the Milky Way's gravitation, its stars eventually to be assimilated into our Galaxy. It was discovered accidentally in the mid-1970s on a photograph in the Palomar Sky Survey; its existence was confirmed by radio observations. It was dubbed "Snickers" by its discoverer because "it's like the Milky Way, only peanuts." Our Galaxy is now believed to have four companions, as the Small Magellanic Cloud has recently (1983) been resolved into the SMC and the Mini-Magellanic Cloud Remnant; the Large Magellanic Cloud completes the presently-known set.

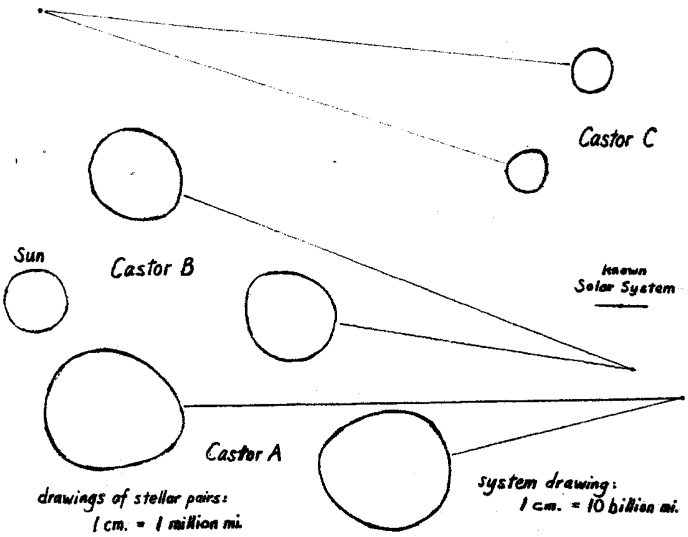
The Great Dog, *Canis Major*, has long been seen as the Dog of Orion. The pairing of it with Canis Minor, the Lesser Dog, marked by Procyon, is an invention of Roman times.

The brightest star in Canis Major is the brightest star of all our night skies, *Sirius*. Its name is generally taken to be derived from *seirios*, meaning "sparkling" or "scorching," in connection with its great twinkling brilliancy, but also possibly with its appearance with the August sunrises of ancient times, when it was thought to bring with it the hottest days of the year (the "dog days"). It has also been suggested that its name descends from the Egyptian deity Hesiri, known to us as Osiris. Sirius is a bluish-white star with a surface temperature of 10,000 K (17,500° F.); it has 23 times the Sun's luminosity, 1.8 times the size, and 2.35 times the mass. It lies 8.7 light-years away, making it the fifth nearest known star to our solar system.

In 1718, Edmund Halley announced his deduction that Sirius, Arcturus, and Aldebaran had moved from the positions indicated for them in records of some 2000 years earlier. This led to studies of what became known as the proper motions of stars, their gradual apparent changes of position against the distant stellar background. Between 1834 and 1844, the astronomer and mathematician Freidrich Bessel found that the proper motion of Sirius was not linear, but wavy, suggesting to him the presence of an invisible companion orbiting Sirius with a period of about 50 years. Even though the mutual orbits of the pair were calculated by 1851, the secondary star eluded telescopic searches. In January of 1862, the renowned telescope maker Alvan Clark was testing a newly-constructed 18½" refracting telescope, then the largest of that type in the world (destined for the Dearborn Observatory at Northwestern University), at Cambridge, Massachusetts. While waiting for Sirius to emerge from behind the edge of a building, he was able to view the faint companion while the glare of the much brighter star was obscured. This was the first white dwarf star to be observed. Sirius B is an object having 0.98 the Sun's mass, yet is only 15,000 miles across: this gives it an average density about 125,000 times that of water. It has a surface temperature of about 9000 K (15,700° F.); it is about 1/400 as luminous as the Sun. White dwarfs are the bare cores of dead stars originally not more than about three times the Sun's mass; they no longer generate energy through the agency of nuclear fusion, but simply radiate away what energy they contain. In normal stars, the tendency to collapse under gravitation is counterbalanced by the outward pressure caused by energy production from within. In a "dead" stellar core, the outward pressure is instead provided by a quantum-mechanical effect known as electron degeneracy pressure. Electrons belong to a class of particles, called fermions, which are possessed of a property that forces each one to assert its identity, so to speak, when confined to a very small volume. Pressure from without causes a group of fermions to resist that pressure by forcing individual members to progressively higher energies, up to a limit. The result is that a dead-cold (0 K or absolute zero) ball of matter of up to 1.4 times the Sun's mass can remain a stable structure against gravity purely through the support of the degeneracy pressure of its electrons. For his work in applying the results of quantum mechanics to such issues in stellar theory in the 1930s, Subramanian Chandrasekhar (now at the University of Chicago) shared the 1983 Nobel Prize for Physics.

Gemini has been seen as a celestial pair from quite ancient times. They come down to us from Roman mythology as the fraternal-twin sons of Tyndarus and Leda.

Castor, the horseman and the mortal Twin, is represented by a star about 45 light-years away. What appears to the eye as a single point of light is seen in small telescopes as a pair of stars, accompanied at a distance by what looks like a faint red star. The binary pair, Castor A and B, orbit one another with a period of about 400 years, with an average separation of around eight billion miles; Castor C lies some 100 billion miles from the pair. The truth is somewhat more complex: each of the three stars is in turn a spectroscopic binary. Castor A is a pair of white stars, each with 1.6 times the Sun's mass, 12 times its luminosity, and twice its size, separated by about four million miles; B is another duo of white stars, each about 1.2 times as massive as the Sun, six times as powerful, and 1½ times as big, separated by under three million miles; the remote set, C, consists of two orange stars about 1.7 million miles apart, each around 3/5 the Sun's mass, 0.7 times the size, and 1/40 as energetic. This Twin, then, is really a set of *three* twins!

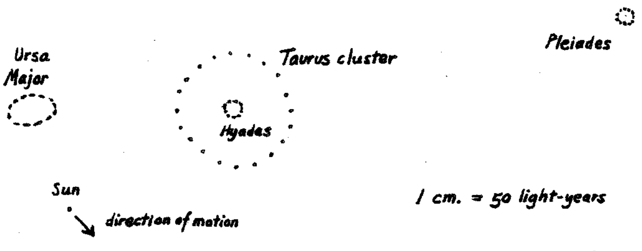

Castor C
Sun
Castor B
Known Solar System
Castor A
drawings of stellar pairs: 1 cm. = 1 million mi.
system drawing: 1 cm. = 10 billion mi.

The pugilist and immortal Twin is *Pollux*, or Polyleukes. The star is four to five times as big as the Sun and about 35 times as luminous. Its surface temperature is 4500 K (7600° F.); it is about 35 light-years distant.

Procyon is the brightest star in Canis Minor, the Small Dog. The name comes from the Greek *prokuon*, "before the Dog," as it rises before Canis Major and Sirius. It is the 14th nearest known star and the eighth brightest in our night skies. It is 11.3 light-years removed from us; it is 1.7 times the Sun's mass, about twice the size, and six times as powerful; its surface temperature is 7000 K (12,100° F.). Like Sirius, Procyon too has a white dwarf companion. Procyon B is about 0.65 of the Sun's mass, is about 1/2000 as radiant, and is around 17,000 miles across. Its presence was deduced from observed perturbations of the motion of Procyon A in 1861; it was finally observed with the 36" refractor at Lick Observatory, overlooking San Jose, California, in 1896.

The complete constellation of *Ursa Major* was seen as a Bear by many ancient cultures. In one myth, it is the transformed Callisto, the missing seventh Sister of the Pleiades. The Big Dipper, as it is very widely known today, was also viewed as a Wagon or Chariot or as a Plow.

The central five stars of the Big Dipper have a common proper motion through space. They are found to be the most prominent members of a group of perhaps seventeen stars, called the Ursa Major moving cluster. The center of this aggregation is about 75 light-years away; the cluster seems roughly ellipsoidal, with a length of around thirty light-years and a width of about 18 light-years. The hottest stars in it are around 10,000 K, so this cluster is about 300 million years old. We are presently passing by three open star cluster in the Galactic disk as we orbit the core: Ursa Major rather closely, the Hyades, and the Pleiades.



Leo was taken for a Lion at least as far back as the early Egyptians and the Babylonians. In Greek and Roman myth, it became the Nemean Lion, which Hercules was commanded to slay as one of his Twelve Labors.

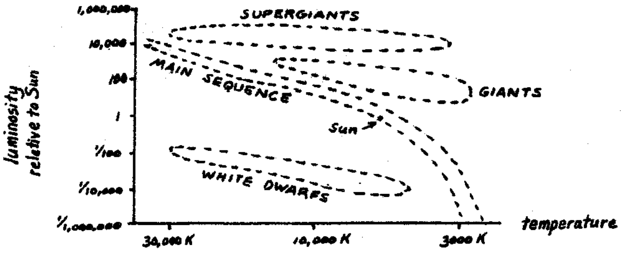
The star *Regulus* , the diminutive of Rex or "King", was so named by Copernicus as it was long thought astrologically to rule the affairs of the heavens. To the ancient Persians and Hindus, it was one of the four Royal Stars, since it marked the location of the summer solstice some 4000 years ago; the other three were Aldebaran (vernal equinox), Antares (autumnal equinox), and Fomalhaut (winter solstice). Regulus is about five times as big as the Sun and 160 times as luminous; its surface temperature is 13,000 K (23,000° F.); it lies 85 light-years away. It is followed by a binary star at a distance of about one-tenth of a light-year, which may be in a very long orbit about Regulus.

People in the southernmost portions of the United States will be just able to see parts of a very conspicuous figure in the "southern" Milky Way. This was once known as *Argo Navis*, a representation of part of the famed ship in which Jason and his crew of fifty sailed; it was seen as a ship, however, long before the Greeks. Modern astronomers have subdivided this enormous constellation into three smaller ones: *Carina*, the Keel; *Puppis*, the Stern; and *Vela*, the Sail.

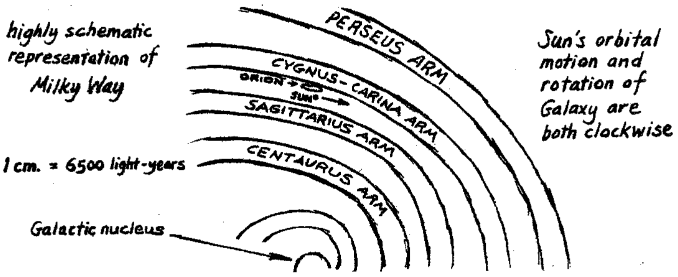
The brightest star in Carina -- indeed, the second brightest star in all the night skies -- is *Canopus*. It may have been named for the chief pilot of the fleet of Menelaus led against Troy; the name may also have come from the Egyptian *Kahi Nub*, meaning "Golden Earth," in reference to its apparent brilliant yellow color and its closeness to the horizon as seen from Egypt. Its true color is closer to white: the false hue comes from northern observers viewing it through a maximum thickness of atmosphere. In fact, because of its low elevation for most observatories, it was not well studied until this century. It is a yellow giant star, about thirty times as large as the Sun and 1400 times as powerful; it lies something over 100 light-years from us.

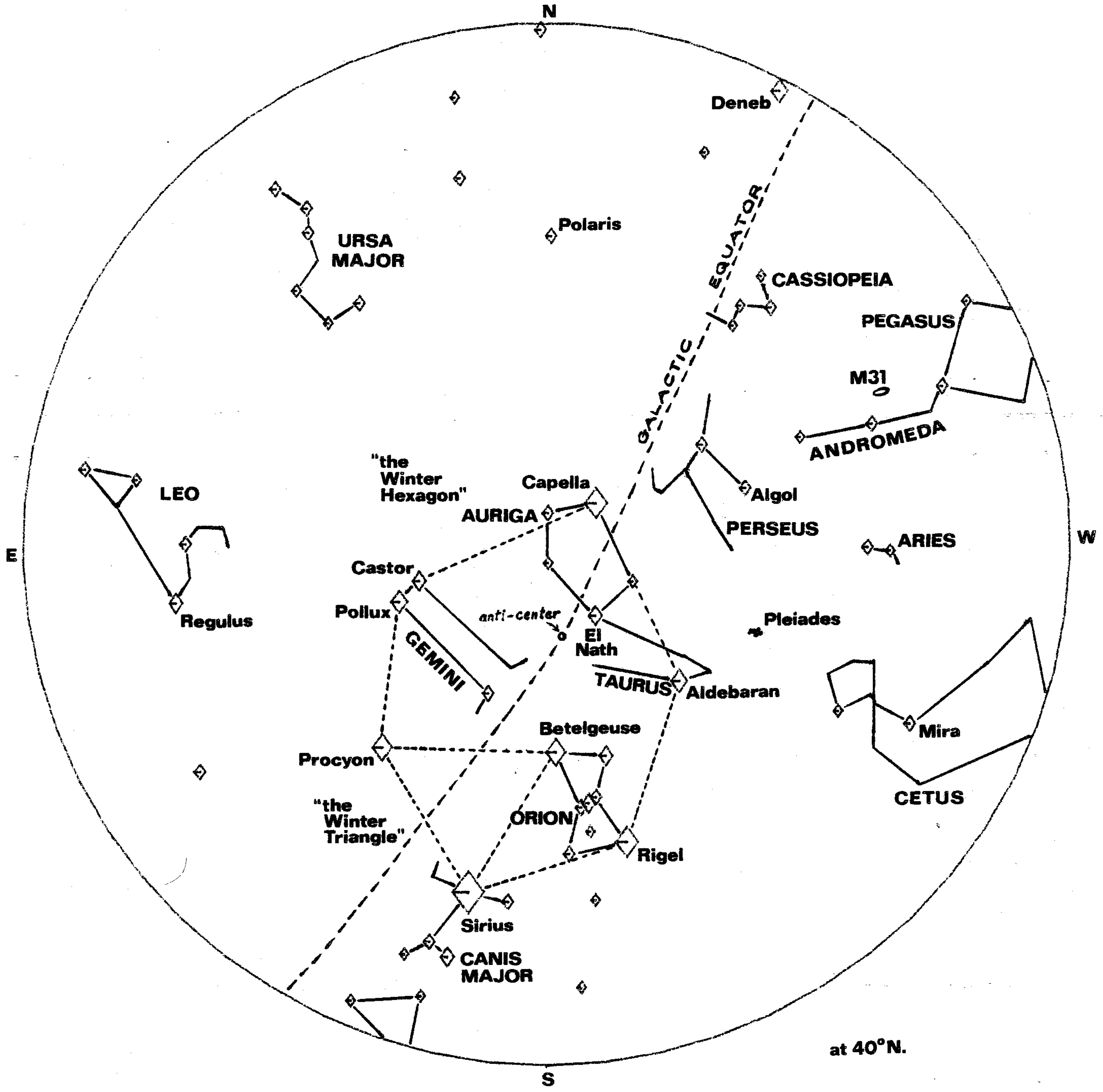
In these first two essays, we have looked at eighteen different stellar systems. Eleven of them are represented by a single star (so far as we know); the other seven systems contain a total of 22 separate stars. Even these limited statistics illustrate a principle seem more generally among the stars: about two-thirds of all stars are found in pairs or larger groupings; solitary stars are the uncommon ones. Some theoreticians believe that the formation of stars always produces such associations. The process can lead to any ratio between the masses of the bodies. In our own solar system, Jupiter is a sort of Sol B with a thousandth the Sun's mass, Saturn a third companion with 1/3000 the mass of the Sun; these objects are far too small to be stars or to disrupt the stability of the system as a whole.

In the early 1910s, the American astronomer Henry Norris Russell and the Hungarian Ejnar Hertzsprung independently arrived at the idea of arranging stars according to their luminosities as a function of surface temperature. The radiant output of a star can be worked out from a measurement of the light reaching us and an estimate of its distance. The temperature could at last be determined from a study of the spectrum and from the emerging atomic theory derived from quantum mechanics. What the Hertzsprung-Russell diagram revealed is that stars do not have totally arbitrary characteristics. Instead, they tend to fall into fairly distinct classes, as shown below. Ninety percent of the stars lie along the major diagonal called the main sequence. The remaining ten percent are roughly equally divided among the giants, supergiants, and white dwarfs. What the significance of this distribution is did not become clear until the 1950s, when nuclear physics was well enough defined to be applied to matters of stellar behavior. Some of that story will be detailed in the next segment.



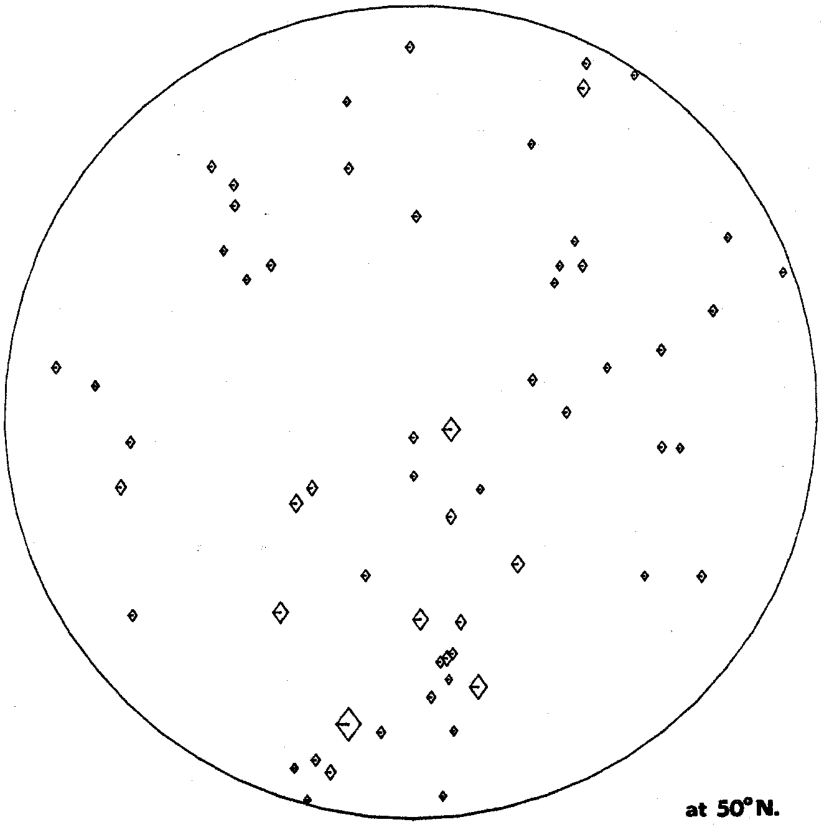
The Orion association, as has been said, is a region where new stars are beginning "life" today. Such areas are found in the spiral arms of galaxies. From studies of the distributions of young, hot, very luminous stars and of interstellar hydrogen in our Galaxy, we have learned that the bright stars of Orion lies in an outcropping, the Orion Spur, of one spiral arm called Cygnus-Carina. We are presently between arms on a roughly circular orbit, having passed out of the Cygnus-Carina Arm perhaps some ten million years ago.


highly schematic representation of Milky Way
PERSEUS ARM
CYGNUS-CARINA ARM
ORION
SUN
SAGITTARIUS ARM
CENTAURUS ARM
Sun's orbital motion and rotation of Galaxy are both clockwise
1 cm. = 6500 light-years
Galactic nucleus

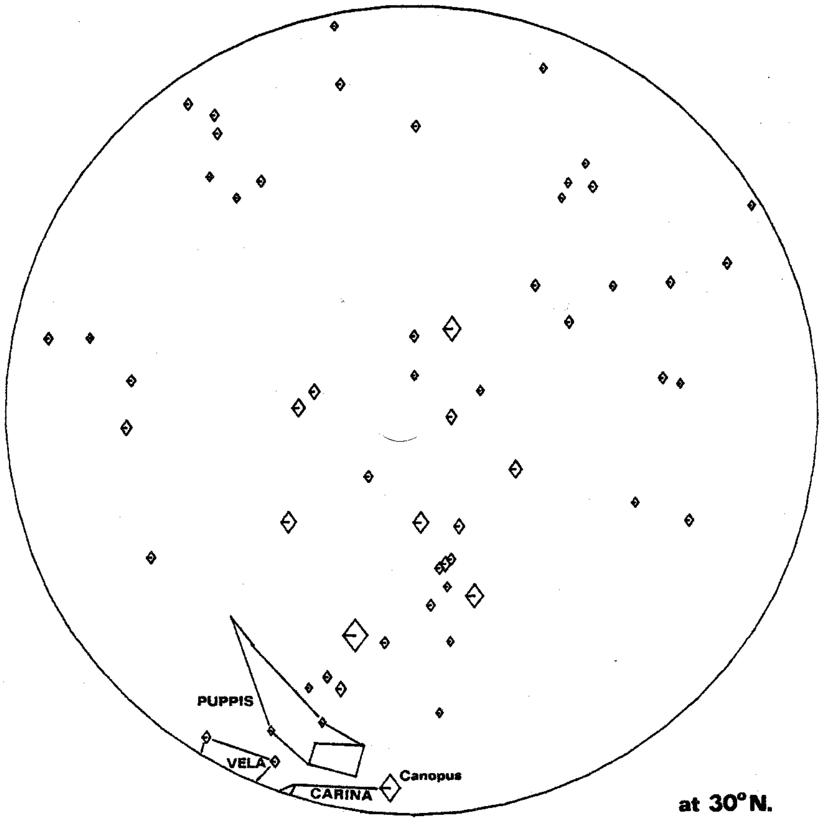


the sky at six hours sidereal time

it appears as shown at: 11:20 PM local standard time on 1 January
9:20 PM " " " on 1 February
7:20 PM " " " on 1 March



at 50°N.



at 30°N.

A Short Essay *on the nature of scientific thought and its alternatives, given in somewhat metaphysical terms, admitting of at least one oversimplification, submitted as much for the propagandizing of a personal point of view as for the entertainment of the general readership.*

by Jefferson P. Swycaffer

In the science fiction and fantasy writings of Fritz Leiber, much mention is made of the Snake and Spider War. A new volume has been released, containing the collected stories that has written about "The Change War." In Leiber's tales, two factions of time travellers, the Snakes and the Spiders, seek to destroy each other and control the known four-dimensional universe. The partisans are as human as the rest of us, and the names are only the names of the parties (in the same way the Communists are seldom actually 'Red,' nor patriots 'true blue.')

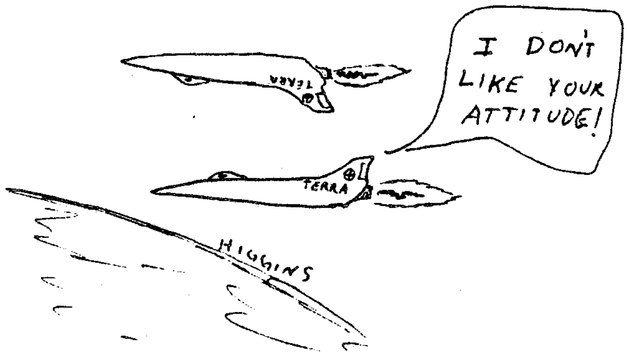
Leiber never specifically states what the two factions believe, nor what the causus is for their war. For a lark, I have developed the following, which is picturesque, if nothing else, and has a cheerfully symmetric dualism.

Suppose that the Snakes are the scientists, the codifiers, the logicians. They are the builders, the organizers, the conquerers. The Imperial Romans, with their roads, armies, and their way of thought, could be called Snake-like, as were the sixteenth-century Spanish. This is a philosophy with an urgent dynamicism, a way of thought that sets goals and which measures progress. It is highly materialistic, very straightforward, and immeasurably strong. It moves mountains. It took adventurers to the Moon. I would not bet against it someday taking them to the stars.

Suppose the Spiders to be the mystics, the holistics, the patterners. The Hopi Indians are possibly the best example, believing as they do in the Greater Pattern, the knowledge behind what seems to be. Spiders believe in an unchanging stasis, and in unseen causes. They stress understanding over simple knowledge, and practice a highly idealistic philosophy.

I know a young woman, shy and retiring, who has embraced a mystical religious spiritualism. She gives worship to the mysteries of the Goddess in quiet, candlelit ceremonies on the chill night of Beltane. She reads futures, arcane signs, and living auras; she knows that the universe is a living, loving entity. She will tell anyone who asks that Science, while perhaps a once-valid means of inquiry into the nature of the world, is now a dead and fossilized discipline. She may be labelled a Spider.

I know a young man who builds lasers in his living room. He's good at math and electronics, and he can do things with epoxy cement that would freeze your heart. He has no use whatever for ignorance or for irrational mysticism. He can say "That statement is operationally meaningless" and make it sting. He's cerebral, thoughtful, logical, sensible, and forthright: He has his plans for the day, and his plans are good ones. He is highly likely to get things accomplished efficiently, and to have fun while doing so. He may be labelled a Snake.


I DON'T LIKE YOUR ATTITUDE!
TERRA
TERRA
HIGGINS

Reason is the central issue here: What role does reason have in the governance of everyday life? Martin Luther declared that Reason was a traitor, since it led man to reject the spiritual in favor of the material. Yet his Reformation led inevitably to the Age of Reason, where modern science was birthed. The question is asked: Can the truths of the cosmos be learned through reason, through observation, through deduction, or must they be intuited? Plato's idealism stressed a turning away from the material world in any search for truths, yet Aristotle's methods led to close observation of the material world for truths.

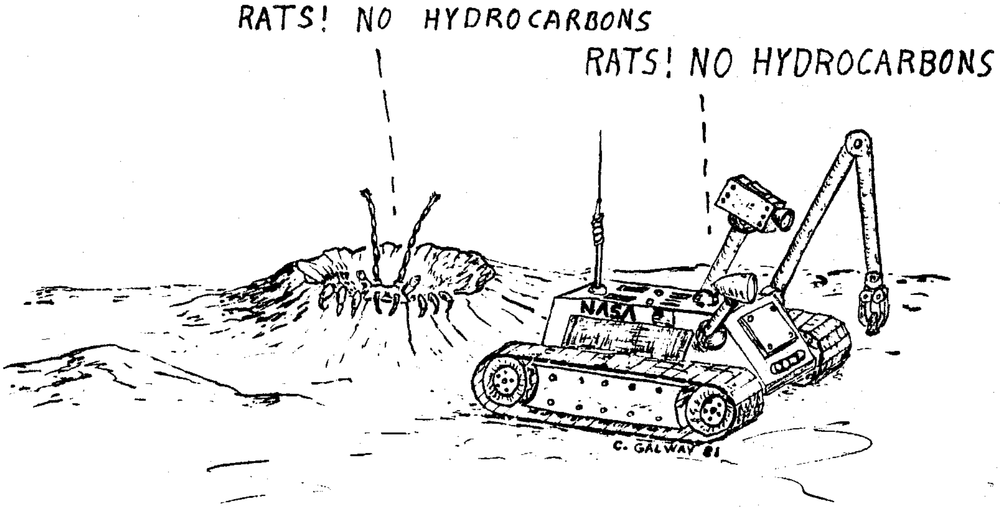
The aspect of "seeing" is very important here. Carlos Castenada, whom I would characterize as a Spider, says often in his Don Juan books that Seeing is essential. To See, to perceive more than what is before our blind and fallible eyes, is the primary goal of wisdom. The world, he claims, is only a shadow cast upon a curtain of billowing smoke. The wise man will understand this, and whether by meditation, drug-use, or prayer, will endeavor to pierce the cloud of illusion and win through to a higher truth. Science is charged with being blind, and rationalists are accused of not being able to see what is directly before their faces.

This is perhaps true. Science is model-dependent, and tends to see the model as a depiction of reality. Modern physics is a language wholly of mathematics, obscuring the solid reality of matter. A Doctor of Astronomy might gaze all day at ellipses drawn on computer printout sheets, and sleep peacefully at night while cold stars unwinkingly eye his rooftop. The charge becomes poignant when we consder that the computer-generated ellipses are false, while the planets are real. The map is not the territory.

The Snakes, with their result-oriented view, have used those abstract ellipses to land a camera on Mars. It is the joy of the Snakes' directness to point at results, and to send out servants -- Viking, IRAS, LandSat -- to see things we ourselves cannot. Visibility -- Seeing -- can be extended by machine, as well as by meditation and drugs. Sight is not solely an attribute of mind.

Is the universe understandable? The Snake mind claims a hearty "Yes!" The Spider view gives a clear denial. One analogy, given in the 1940's during the London Blitz, suggested that Science is like a powerful searchlight, shining upward like a powerful beam, illuminating the airplanes that fly into its path. But there is an entire sky full of airplanes that cannot be seen in this light. How do we know that there are planes there at all? Simple: They drop bombs on us.

The spiritual bombs that the airplanes of mind can drop upon us are, like bombs in a real air-raid, surprising and upsetting. At any time, a man may rock back on his heels and wonder, "Just who the hell am I?" The feeling is powerful and frightening. Dark Freudian gulfs surround our minds, and, rational or not, little fears and great phobias govern many of our decisions. If a man were to be totally rational, lacking all spiritual qualities, it is doubtful whether he would deign to draw his next breath. Irrational art is still the best reason for living. A totally spiritual man



should live naked upon a mountaintop, blind from staring into the heart of the sun, but with a greater vision than mortal eyes would bear.

Is the universe understandable? The sensible snake relies upon the definition of "nonsense" to circumvent such timeless questions as mind, soul, spirit, and the gods or God. The questing Spider scorns the purely temporal discoveries of the Snakes' learning, pointing out the dangers in any world-view that is not holistic and reverent.

Each view is flawed without help from the other. Technology without an ecological overview led to the dire pollutions of the previous decade, and to the subtle pollutions of this decade. Pure holism would lead to a prohibition of all progress, since the cultivation of land is an affront to the spirit of the land.

The aspect of direction is important here, and leads to the reason behind the symbology. The snake is the very symbol of direction; the Snake strikes, moving forward; it is an arrow or a spear. Science plunges onward, learning new truths. Technologies are built, along with roads and marching armies. Enemies are struck down: Smallpox and slavery are among the victims of the Snakes. The spider is a symbol of stasis. The Spider sits, composed, knowing, at the center of all things. Its eight arms form a mandala, a mystic symbol of great power. There are cycles, eight-fold paths. As Rome fell, so will fall this proud Rome of material blindness. The Spider-Woman goddess of the Hopis can be contrasted with the Genesis Snake of the Gnostics; the hidden Weaver of Fates with the knowledge and language of Choice.

Just as the two philosophies are best when taking elements of grace from each other, so they strenuously resist merging. The bitter acrimony between the two views is harsh and long-lived. The debate of creationism vs. evolution, and the battle over the utilization of nuclear power, show that the feud is heated. One of the battlegrounds is medicine, where the treatment of the ill and injured is seen by both sides to be cruel and passionless. Snake medicine takes chemicals out of the body, and puts chemicals into the body, removing from a man the dignity of his person. Yet Spider medicine is rank charlatanry of the grossest sort, with full cures of nearly any disease promised by men who will massage the patient's spine, and with colonic irrigation and hypnotherapy seen as natural healing processes.

This is not just the old debate between science and religion, although that is a significant aspect of the battle. Rather, the debate is between the world-views that make science and religion possible.

Science, it should be remembered, is dependent upon its metaphysical underpinnings, and religion began as an early form of explaining the capricious natural universe. We live in an era only now beginning to have room for both views: No one true way can accomodate the previously unguessed richness of the truth. If we succeed in crossing Spiders with Snakes, we will either arrive at sapient and questing Octopi, with the best features of both, or with a radioactive desert, the heritage of those who would rather that all die than that others be proven right. ■

Editor's note: Jeff Swycaffer lives in San Diego. His first book, Not In Our Stars, has just been published by Avon.

Last Writes

In case anyone is wondering, this is issue 35' (that's right, "thirty-five prime") to distinguish it from the other "issue 35", published in April of '83, which should really have been numbered 33. Next issue will be number 36, and sequential numbering will resume. I hope.

Speaking of the next issue... we have pretty much worked the bugs (and dried ink and gummed-up oil) out of our Gestetner, so future Pyros will likely be mimeo'd, full size, instead of the reduction Xerox that's been the norm until now. It'll be easier to read and easier to lay out, and the savings in repro costs will more than offset the additional postage. Besides, it'll be convenient to be able to do our repro right here at home... even though using the word "convenient" in relation to any aspect of the stencil duplicating process may seem to be an oxymoron.

Art Credits for Pyro 35'

Greg Ruffa and Alice Bentley:	3
Dave Levine:	3
Bill Higgins:	8
Charles Galway:	9

"There are no Macintosh graphics in this fanzine."

This Space Available

Except for the partly-baked ideas churning in my brain, this issue pretty much exhausts our reserves of unpublished text and graphics. HELP!

What am I looking for? Answer: Anything that might be of interest to the readers. Yes, that covers a lot of ground. Articles about science fiction or fantasy (no, we're not fantasy-phobes here) are of course germane; so are book and media reviews. I'd like some guest contributors for the "Hard SF in the 80's" column. Non-fiction pieces dealing with science and technology are welcome too. And, no, I won't reject out-of-hand things that I don't agree with, or this will become a pretty boring fanzine.

We also need artwork (covers in particular). We will probably be experimenting with repro techniques over the next few issues, so I don't want to quote sizes based on our current reduction ratios. Send whatever size is convenient, and I'll enlarge it, reduce it, or run the text around it so it fits. Of course, the final-size pages will always be 8-1/2 x 11 (including margins), and we'll always be able to use final-size art.

Alas, we can't pay for contributions, but we will send you free Pyros in exchange for them. How many depends on what you send in and how often. I don't have a fixed formula in mind but you will certainly receive gratis any issue in which your work, or comments on your work, appears. A regular contributor who can be counted upon for a few articles, illos, or LOCs per year can probably count on getting Pyro free for as many years as he or she (and I) can keep it up. ■

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